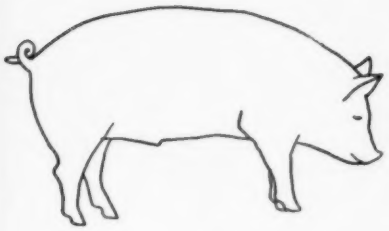
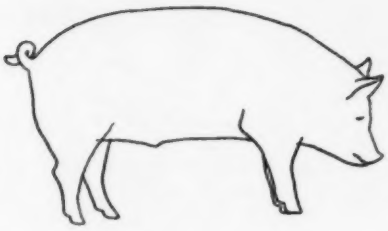
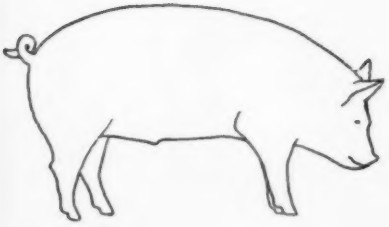
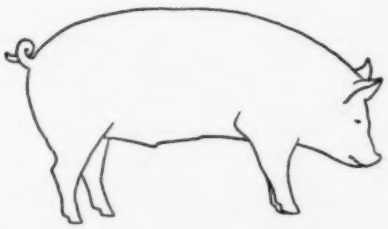


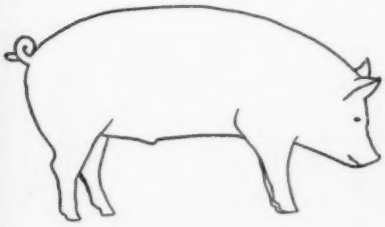


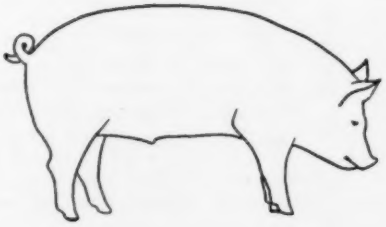
Successful Swine Production

W. G. Pond and E. A. Pierce









CORNELL EXTENSION BULLETIN 1045
New York State College of Agriculture

CONTENTS

SUCCESSFUL SWINE PRODUCTION

W. G. Pond and E. A. Pierce

The swine industry in New York State is not large in comparison with other agricultural industries which contribute to the over-all gross farm income. However, for some areas in the state and certain individual farmers, hog raising is an important enterprise. The average annual gross income from swine during the five-year period from 1950 to 1954 was $12,438,400. This amount is slightly less than 1½ per cent of the average total gross farm income, but it is approximately 16½ per cent of that received from the sale of all cattle and calves produced in the state during the same period.

Interest in hog production in the central and lake plain regions of western New York has been stimulated by the rather large increases in corn production in this area. A study of the economic possibilities of hog production in western New York, conducted during the period February 1, 1957 to February 1, 1958, definitely shows that hogs can be a profitable enterprise on many farms there. In this study the average labor return for all farms was $1.74 per hour, whereas over 20 per cent of the farms studied realized more than $4.00 per hour on their swine production enterprise.

Though most swine enterprises in New York State are small (less than 10 sows), many farmers with extra corn or other feeds would find it profitable to feed and grow pigs as a way to use these surplus products. With the exception of poultry, swine are the most efficient converters of feeds to meat, and they require relatively small investments in facilities and equipment. The labor requirements for a swine enterprise are low and the peak periods can be adjusted to avoid the heavy labor loads of other enterprises. This feature allows them to fit in well with practically all types of farming such as dairy, poultry, fruit, and vegetable. Swine-raising is exceptionally well suited for general farming situations where the production of corn and other grains are major enterprises, and it is an excellent companion to cattle-feeding operations.

For many years, the annual consumption of pork by the American public has averaged more than 60 pounds per person, and while per capita consumption of pork has decreased slightly from previous levels, the continuing growth of the population points toward a sound future for those producers engaged in the production of swine of desirable type and quality.

The swine industry recognizes that today's calorie-conscious consumer wants high quality pork, with a high ratio of lean to fat. This fact, plus the competition from vegetable oils, has added impetus to the trend away from lard. Emphasis on conformation typifying both lard-type and bacon-type hogs no longer exists in this country. Instead, the term "meat-type" has become familiar in swine circles. "Meat-type" denotes a hog that will yield a carcass containing a high proportion of lean meat and a minimum of fat. A successful swine industry or enterprise, therefore, is one which will not only meet but maintain the standards of product quality demanded by today's consumer. In so doing, the barriers that discourage consumption of pork in favor of other commodities will be minimized.

TYPES OF SWINE PRODUCTION

There are two distinct types of swine production, purebred and commercial. Although the problems involved in both types of production are similar, enough differences exist in the operations to warrant their discussion.

Purebred Production

The number of registered purebred swine represents only a small percentage of the total swine produced in this country. However, it is this segment of the industry that supplies the foundation breeding stock for use in the commercial swine herds and which lays the ground work for changes and improvements in swine type.

Accurate records of ancestry, breeding and farrowing dates, and an active and continuous advertising and promotion program are essentials of a purebred production program which make it differ from a commercial operation. These essentials require more attention to details, more labor, and better management if the operation is to be successful. Though opportunities for selling breeding stock at better than market prices are afforded purebred producers, the increased expenses and greater efficiency required for this type of production limit the number of producers engaged in it.

As leaders in the industry, purebred producers are devoting considerable effort to the development of heavily muscled "meat-type" hogs.

One of the most valuable contributions to the production of hogs which meet consumer demand has been the development of the production registry and certification programs by the purebred swine associations. These programs vary somewhat among the breeds, but the general provisions are the same. Table 1 shows the requirements that must be met for a litter to be eligible for production registry and certification.

TABLE 1. REQUIREMENTS FOR PRODUCTION REGISTRY AND CERTIFICATION

For Production Registry—Based on litter size and performance

	No. of pigs weaned	Weight of litter at weaning
Gilts	8	Varies according to age and breed — Minimum for most breeds is 128 lbs. at 35 days of age
Sows	8	Minimum for most breeds is 152 lbs. at 35 days of age

For Certification—Based on carcass standards

Live Weight*	Area of loin eye (minimum)	Length (minimum and maximum)	Backfat thickness (minimum and maximum)
180 to 199 lbs.	3.50 sq. in.	28.5″ to 31.5″	1.1″ to 1.6″
200 to 214 lbs.	3.75 sq. in.	29.0″ to 32.0″	1.2″ to 1.7″
215 to 230 lbs.	4.00 sq. in.	29.5″ to 32.5″	1.3″ to 1.8″

*Liveweight must be 200 lbs. at 180 days of age or its equivalent based on a correction factor of 2 lbs. subtracted or added for each day of age more or less than 180.

Commercial Production

Most of the swine produced in this country are not of any one particular breed but consist of offspring of purebred boars mated to grade sows of the same or of another breed. This type of production is referred to as commercial hog production and it is the segment of the industry which produces the great majority of the nation's pork supply. Although accurate records and good management are essential in either type of production, commercial operations differ from purebred in that the expenses and details involved in the advertising and promotion of a breed are eliminated. Also, commercial production can be more specialized since a producer may choose only one or all of the common methods of swine production, whereas a complete program requiring more facilities and better management is essential in purebred operations.

The three general methods or types of enterprises followed in commercial swine operations are: (1) the production of feeder pigs; (2) the growing and finishing of pigs; and (3) a complete sow and litter program including the growing and finishing of pigs for market. The type of enterprise chosen will depend on the interest and experience of the producer as well as on the equipment and facilities which he has available. Feed supply and market outlets may also affect his decision.

Feeder Pig Production

Feeder pig production is the first phase of a hog production program. It involves the care and management of a breeding herd and requires strict attention to breeding and sanitation practices. Compared with the other types of swine production, it involves a heavy labor load, and the equipment and facilities needed for a satisfactory job are expensive.

This type of swine enterprise is perhaps best suited for those producers who have a surplus of available labor and a limited supply of feed. Producers specializing in feeder-pig production have the disadvantage of having to depend on operators in a growing–finishing operation for their market, and thus they are somewhat limited as to the time of marketing and the volume of their sales.

Growing and Finishing Pigs

A growing–finishing program is the simplest type of hog enterprise. It involves the least amount of both equipment and managerial ability. There are two general systems in use for the growing and finishing of hogs. These are feeding on pasture and feeding in confinement. Both systems are satisfactory and if properly managed should produce satisfactory results. The only requirement for a growing–finishing program is a pasture or confined area for the hogs and a readily available supply of feed.

The dry-lot or confined method of feeding has received considerable attention recently. It appears to have several advantages over feeding on pasture, the most important of which are the generally faster rate of gain and the opportunity to utilize the land more profitably for other crops. A disadvantage of this program is a somewhat higher labor requirement. For best results, pigs should be fed on a paved surface to alleviate the problem of manure removal, which is of considerable importance when operating a confined feeding program.

Complete Sow and Litter Program

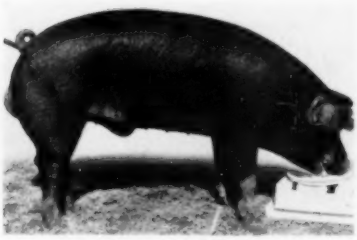
This is the most common method of hog production and requires approximately the same management and operational facilities as a purebred operation. It includes the problems of feed-

Berkshire barrow

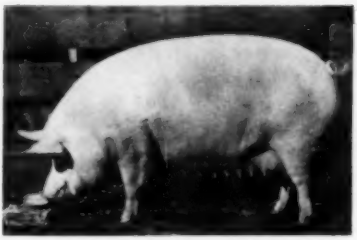
Landrace gilt

Chester White gilt

Spotted Poland China gilt

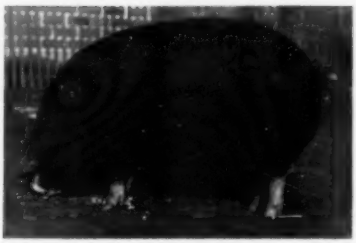


Duroc boar



Yorkshire sow

Hampshire boar



Poland China barrow

All photographs on this page were supplied through the courtesy of the respective breed associations.

er-pig production as well as those of growing and finishing hogs. Swine producers using this program have the advantage of supplying their own feeder pigs and controlling the quality of their market hogs by their choice of breeding stock. They need not wait for either a supply of feeder pigs or a market for them. The major decisions are the number of sows to farrow and the time for them to farrow. These decisions are based on current and future market prospects and on the supply of feed available.

BREEDS OF SWINE

When selecting a breed of hogs it is important to realize that no one breed excels all others in all aspects of productivity. Excellence in one or more traits may be associated with one breed or another, but individual animals that have superior traits can be found in any breed. Also, there is more variation in quality within a given breed than between breeds; thus producers can develop outstanding hogs regardless of the breed chosen.

There are about twenty recognized breeds of swine in this country. Some of the more common breeds are shown on the opposite page and their characteristic features are presented in table 2. Detailed information about any certain breed may be obtained from the office of that breed association.

RECORDS

The most important link in the chain of activities involved in a successful hog operation is that of keeping adequate records. The kinds and extent of records that must be kept will vary considerably from one enterprise to another. For instance, a purebred operation requires more complete and extensive records than a finishing pig operation. The types of records needed may be categorized as follows:

Feed Records

Any business venture, agricultural or otherwise, must have an accurate cost accounting system if it is to be successful. For the swine producer, feed costs represent 75 to 85 per cent of the

TABLE 2. SWINE BREEDS AND THEIR CHARACTERISTICS

Breed	Origin	Color markings	Ear carriage	Number recorded in 1959
Berkshire	England	Black with white feet, face and tail	Erect	19,374
Chester White	Pennsylvania	Solid white	Drooping	14,192
Duroc	New York	Red—varying from golden to deep cherry	Moderately drooping	66,868
Hampshire	Kentucky	Black with white belt around body at shoulders including both forelegs	Erect	56,017
Landrace	Denmark and Norway	Solid white	Drooping	36,807
Poland China	Ohio	Black with white feet, face, and tail	Drooping	25,201
Spotted Poland China	Indiana	Black and white spotted	Drooping	15,105
Yorkshire	England	Solid white	Erect	29,721

Sow Record

Herd No. .....

Breed | Sex | Name | Reg. No.

Date of birth | No. of pigs in litter | Raised - Boars | Sows

Sire | Reg. No. | Dam | Reg. No.

Bred by	Price paid	Age	Wt.	Age	Wt.	Age	Wt.
Show record							
Disposal							
Remarks							

Date		Name and Reg. No. of boar used	Date farrowed	Pigs farrowed		Pigs raised		Litter No.	Remarks
Bred	Rebred			Boars	Sows	Boars	Sows		

Litter Record

Sow's herd No. .....

Litter No. .....

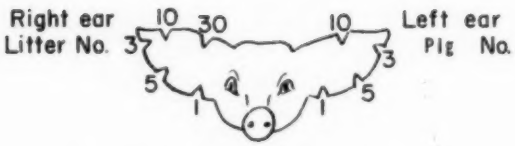
Sow's name | Reg. No. | Breed

Sire's name | Reg. No. | Breed

Date farrowed | Date weaned | Date vaccinated

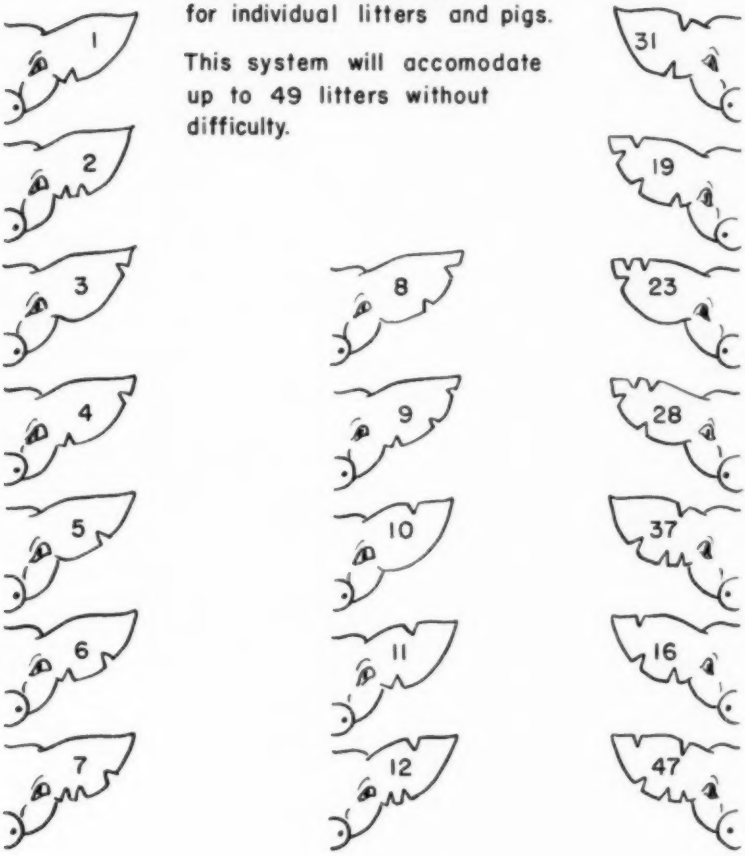
Sex	Birth Wt.	Ear No.	Strong	Medium	Weak	Dead	Wt. when weaned	Remarks and disposition of pig with date

A satisfactory form for keeping farrowing and litter records.



Key to ear-notching system for individual litters and pigs.

This system will accomodate up to 49 litters without difficulty.



A simple and efficient ear-notching scheme.

total production costs. Records of the cost per pound of total feeds and feed ingredients are helpful. Many price situations will justify substituting certain feeds or grains for others to provide a more economical ration. It is also important to know the total feed costs per pound of gain. When all the feed nutrients required by the animal are not supplied in sufficient amounts, a ration is not economical no matter how inexpensive it may be on a per hundredweight basis.

Cost Records

In addition to records of feed costs, attention must also be given to costs of labor, maintenance, insurance, veterinary services, depreciation on buildings and equipment and other costs which may contribute to increases in total production expenses.

Breeding Herd Records

Accurate breeding and farrowing dates are necessary if adequate control of the over-all production program is to be maintained. In purebred enterprises, the identity of the sire and dam as well as the exact date of farrowing are required for registration of litters and individual pigs.

Since litter size, weaning weight, time required to reach market weight, and efficiency of feed utilization are inherited to varying degrees, records of these factors are important in selecting herd replacements.

Producers participating in production registry programs are required to record official weaning weights on all litters. In addition, certification programs require records of the age and weight of several of the pigs in the litter at the time of slaughter. Commercial producers will also find such records of value in improving the productivity of their herds. Satisfactory forms for such records are shown on pages 8 and 9.

Ear-notching is a simple and very effective means of identifying individual pigs and litters and is essential for good record keeping.

Identification of individual pigs and litters is essential when recording performance data. Ear notching is an effective and commonly used method of permanent identification. Although it can be done at any time, it is easier and more convenient if performed on the baby pigs. A satisfactory ear notching system is shown on the opposite page.

FEEDING SWINE

Feed Nutrients

Formulating adequate rations for swine requires a knowledge of the underlying principles of nutrition. To obtain satisfactory performance, the animal must be supplied with all of the food nutrients essential for general health and well being. The nutrients may be classified in the following way:

Proteins are organic materials made up of many amino acids. There are about 22 amino acids existing in nature and each protein has its own definite amino acid composition.

Ten of these amino acids must be supplied in the ration because the hog

is unable to synthesize them. These are called "essential amino acids". It is the extent to which a protein from a given source supplies these essential amino acids in proper amounts that determines its "protein quality". Feeds containing protein in which all 10 essential amino acids are present in adequate amounts are considered high in protein quality while those deficient in one or more are said to be low in protein quality.

It is the protein in feeds that is converted to protein in the body which forms the lean meat we know as pork. For most efficient use, protein must be present at the right time, in the right form, and in the right amount and balance.

Carbohydrates are organic materials composed largely of carbon, hydrogen, and oxygen. They make up approximately 75 per cent of the dry matter in most plants, and serve as the chief form of energy in swine rations. Carbohydrates may be present as starches or sugars which are readily digested and have a high feeding value, or they may be present as crude fiber such as found in roughages which swine cannot readily utilize for energy.

Feed tags usually designate the amount of carbohydrates in a feed as N.F.E. (nitrogen-free extract) and as crude fiber. The N.F.E. represents the soluble and easily available carbohydrates.

Fats are organic materials containing mostly carbon and hydrogen and are an excellent source of energy. Fats contain about 2.25 times as much energy as carbohydrates. Feed tags usually designate fat as ether extract.

Minerals are inorganic elements which remain as ash when a feed is burned. There are a total of 14 minerals known to be required by swine. These are: calcium, phosphorus, sodium, chlorine, iron, copper, cobalt, manganese, magnesium, potassium, iodine, zinc, selenium, and sulfur. Although required in only small or even minute amounts, minerals perform important functions in the animal's body. They are just as essential for growth, reproduction, and lactation as are proteins, fats, carbohydrates and vitamins.

Vitamins are organic compounds required in small amounts for the proper functioning of the body. All are different in structure and perform different functions. Thus it is important that all of them be supplied in adequate amounts in swine rations. Vitamins can be divided on the basis of solubility into fat-soluble and water-soluble vitamins. Those requiring special attention are vitamins A and D from the fat-soluble group and riboflavin, niacin, vitamin B_{12} and pantothenic acid from the B-complex (water-soluble) group. There are also other unidentified factors present in some of the common feedstuffs which may eventually be identified as vitamins.

Water is so much a part of our every day life that it may not be thought of as a nutrient, but it is definitely required for health and well-being and can rightly be classed as such.

Feeds

Space does not permit listing all the feedstuffs that might be fed to swine under various conditions, but some of the more common feeds used in swine rations are discussed. These can be divided on the basis of crude fiber content into *concentrates* and *roughages.*

Concentrates. Since swine are unable to utilize large quantities of crude fiber, concentrate feeds are of greatest importance in swine nutrition. Concentrates are divided on the basis of their protein content into *cereal grains* and *protein supplements.*

Cereal grains and by-products. The cereal grains differ greatly in feeding

TABLE 3. CEREAL GRAINS AND HIGH PROTEIN FEEDS CONSUMED BY HOGS IN U.S.*

Year	Corn	Oats	Barley	Sorghum grains	Wheat and rye	Soybean oil meal	Cottonseed meal	Other oil meals	Animal protein (excluding milk products)
	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons	1000 tons
1930	24,833	4,000	2,042	250	1,450	—	159	153	551
1935	20,984	3,057	1,173	440	1,050	70	101	145	518
1940	27,729	4,959	2,305	578	299	168	200	462	645
1945	35,705	7,919	1,692	590	2,315	498	150	287	693
1950	36,165	6,559	1,309	460	288	1,305	195	590	764
1955	31,399	7,108	1,994	535	190	1,413	150	135	909
1956	31,346	6,346	2,042	707	300	1,625	154	180	850

*U.S.D.A. Production Research Report No. 21, Consumption of Feed by Livestock, 1909–56.

value for swine, but they are all quite similar in certain respects. As a group they are low in protein content (8–14 per cent), decidedly low in vitamins A and D, low in calcium, and poor in protein quality. No cereal grain alone is a satisfactory feed for swine. They all must be properly supplemented with protein, vitamins, and minerals.

The amount of each cereal grain and high protein feed consumed by hogs during various periods in the United States is shown in Table 3.

Corn. This product is basic to the swine industry and is so much a part of swine production that its price in relation to that of hogs is used as an index in forecasting increases and decreases in the number of hogs produced.[1] Corn is used as the standard when comparing relative feeding values of other cereal grains. Corn will usually have its highest feeding value when fed coarsely ground without the cob. With the exception that white corn is void of Vitamin A value, both yellow and white corn have the same feeding value. They have the lowest amount of protein of any of the cereal grains and both types must be supplemented with other vitamins and minerals and a suitable protein for satisfactory performance. The dry matter in soft (high moisture) corn has the same feeding value as dry matter in sound corn, but the gains are usually not so rapid when soft corn is fed.

Barley. This is an excellent feed for swine and is fed as the only grain in many areas of the United States. Its feeding value will average about 90 per cent that of corn, but this will vary, depending upon its weight per bushel and crude fiber content. Although somewhat higher in protein content than corn, the protein quality is also poor and it must be properly supplemented with vitamins, minerals, and a good quality protein to be satisfactory. Barley should be ground medium to fine for swine. Although slightly less palatable than corn, swine fed rations in which barley replaces up to

[1]Hog corn ratio is the number of bushels of No. 2 yellow corn required to equal the value of 100 pounds of live hog. A hog corn ratio of 10 is generally considered the break-even point.

one-third of the corn will usually perform equally as well as when corn is the only grain fed.

Oats. Oats are an excellent feed for the swine breeding herd. However, they are too bulky and fibrous to be fed as the only grain in the ration for young pigs. Oats have their greatest feeding value when ground and fed as not more than one-fourth to one-third of the total ration. Heavy oats are much better for swine than light oats and may form a somewhat larger part of the ration. Oats are somewhat higher than corn in protein, but the quality of protein is poor and a good protein supplement is required when oats are fed as the only grain in the ration. Because of their wide variability in fiber content, oats vary in feeding value from approximately 75 per cent to 85 per cent that of corn. Oats are an excellent feed for gestating brood sows and can satisfactorily make up one-half or more of the ration without reducing the efficiency of the ration appreciably.

Wheat. This, too, is an excellent feed for swine and is usually equal to or slightly higher in feeding value than corn. However, its value as a cash crop usually eliminates its use as a livestock feed. Damaged wheat or wheat containing a large percentage of cracked kernels may be available at reasonable prices and can be used satisfactorily to replace corn as the only grain in the ration for growing swine. Wheat should be coarsely ground for best results with swine.

Sorghum Grain (Milo). Milo is widely used in the southwestern area of the United States to replace corn as a feed for swine. It varies widely in protein content depending upon variety and on the amount of rainfall during the growing season. Varieties differ as to palatability depending on the tannic acid content of the seed coat. The more palatable varieties are excellent feeds for swine and have feeding values of about 90 per cent to 95 per cent that of corn. Sorghum grain has the same nutritive deficiencies as the other grains, and must be properly supplemented with vitamins, minerals, and protein.

Rye. Although similar to the other grains in nutrient makeup, rye is generally unpalatable for swine and for best results should not replace more than half of the other grains in a swine ration. Rye may contain ergot, a toxic fungus, which will cause abortion if fed to pregnant sows.

Protein Supplements

Animal By-Products

Tankage and Meat Scraps. Both of these materials are high in protein, vitamins, and in calcium and phosphorus. They differ from each other mainly in the method by which they are processed. Tankage, sometimes called digester tankage, is made by cooking meat and fat trimmings and other packinghouse waste under steam pressure. Blood is often added to tankage to bring the protein content to about 60 per cent. Meat scraps, (dry-rendered tankage), are made by a similar method with the exception that the cooking is done in an open vat. The product has less odor and a lighter color than tankage and contains from 50 per cent to 55 per cent protein. The quality of tankage and meat scraps may vary considerably as a result of wide differences in the nature of the raw material. Large amounts of gristle and connective tissue reduce the value of the products while a high percentage of lean meat or of livers, kidneys, or other internal organs improves the quality and value.

Fish Meal. Several kinds of fish meals are available. These are by-products of the fishery industry and consist of the dried, ground, whole fish or fish

cuttings. Menhaden is the most commonly used fish meal for swine, but others include sardine, salmon, tuna, and other fishes. The protein content is usually above 60 percent and the protein quality is excellent. Fish meals are excellent sources of minerals and vitamins, and in general, are superior to tankage and meat scraps as protein supplements for swine.

Feather Meal. This is a product resulting from the steam pressure treatment of feathers from slaughtered poultry. It contains more than 80 per cent protein. Results from feeding trials indicate that it is of limited value in rations for swine because of its poor protein quality. Limited information indicates that it can be used to replace one-third of the soybean meal in a corn–soybean meal ration for swine without adverse effects on rate of gain.

Dairy By-Products

Skim Milk and Buttermilk. These materials are essentially equal in composition and make excellent protein supplements to rations for swine. They contain approximately 9 to 10 percent dry matter, of which about one-third is protein. On this basis, 100 pounds of skim milk or buttermilk will supply three to four pounds of protein of excellent quality. Skim milk and buttermilk are good sources of B vitamins. About 5 pounds of skim milk are required per pound of grain to properly balance a ration for growing swine. Young pigs are unable to consume sufficient quantities of skim milk or buttermilk to meet their protein needs. Skim milk and buttermilk are low in Vitamin A and, when fed with grains other than yellow corn, an additional source of this vitamin must be supplied.

Dried Skim Milk and Dried Buttermilk. These products are usually in high demand for human use and the price is usually too high to make them practical feeds for swine under most conditions. However, if used, 1 pound of the dried skim milk or dried buttermilk will replace about 10 pounds of the undried product.

Whey. This is a by-product of the cheese industry and is higher in water

Milk by-products are extremely palatable and provide an excellent source of protein for young pigs.

content than skim milk. It is also lower in protein, calcium, and phosphorus. Whey is an excellent source of B vitamins and has good protein quality. It has been successfully used as the only protein supplement to barley when fed to pigs weighing more than 100 pounds. Pigs of this size have sufficient capacity to consume enough whey to meet their protein and mineral needs. Whey is low in Vitamin A and must be properly supplemented with this vitamin as well as with proteins and minerals to be satisfactory for young pigs.

Plants and Plant By-Products

With the exception of soybean meal, the plant proteins as a group are only fair in protein quality. They are low in calcium and are rather poor sources of the vitamins. However, their price as compared with protein supplements of animal origin allows them to compete to an important degree as swine feeds.

Soybean Meal. This is an excellent protein supplement for swine and is unique among plant proteins in that it contains a good balance of the essential amino acids. However, it is deficient in vitamins and in calcium. It is good in phosphorus, but some is in a form poorly utilized by swine. There are several processing methods, and if properly employed, each will produce meal of about the same feeding value. Soybean meal is very palatable, and if fed free choice, pigs will often consume more than required to balance their ration. This can be prevented by mixing the soybean meal with less palatable feeds such as alfalfa meal or meat scraps.

Cottonseed Meal. This protein supplement is generally not as desirable for swine feeding because of its poor protein quality. Cottonseed meal is very low in lysine and cannot be used successfully as the only protein supplement to corn or other grain. Satisfactory results can be obtained when cottonseed meal from which the gossypol[2] has been removed replaces up to one-half of the soybean meal in a corn–soybean meal ration for growing pigs.

Linseed Meal. This product is not satisfactory for swine when fed as the only protein supplement. It is poor in protein quality, being low in both lysine and tryptophan. High quality alfalfa meal should be included in supplements containing linseed meal when fed to pigs in dry lot. When fed in combination with animal by-products such as tankage, fish meal, or skim milk, linseed meal may produce satisfactory results if used to replace not more than one-fourth of the protein supplement.

Peanut Meal. This is a very palatable product that is relatively good in protein quality, but the protein is deficient in the amino acids, lysine, tryptophan and methionine. It becomes rancid if stored for more than a few weeks unless it has been stabilized. Peanut meal makes a satisfactory protein supplement if fed in combination with proteins of higher quality. Like the other plant proteins, it is a poor source of vitamins and minerals.

Wheat By-Products. Wheat by-products are good feeds for swine if fed at levels of 15 percent to 20 percent of the ration. Such products as standard middlings (brown shorts), flour middlings (gray shorts), and red dog (white shorts), contain varying proportions of kernel parts, including germ, flour, and bran particles. Since wheat by-products contain only about 15 percent protein, they cannot be considered as truly protein supplements. Their poor protein

[2]Gossypol is a toxic material which must be removed in processing to avoid harmful effects when fed to swine.

quality greatly reduces their value as a source of protein, but they may replace a portion of the grain as a source of energy.

Wheat bran, due to its laxative effect, is a valuable feed for brood sows at farrowing time, but because of its bulkiness, it does not make a satisfactory feed for growing swine.

Cull Beans. These are available in certain areas and make a satisfactory feed for swine. They should be cooked to improve their feeding value and palatability. Cull beans give best results when fed to pigs weighing more than 100 pounds, and when they replace no more than half the corn in a ration that has been properly supplemented with proteins and minerals.

Soybeans. Whole soybeans contain a large amount of fat and will produce soft pork if fed at levels greater than 10 percent of the ration. Raw soybeans are inferior to both cooked beans and soybean meal in protein quality and cannot be used satisfactorily as the only protein supplement.

Roughages

In general roughages are of relatively minor importance in swine rations. However, under some conditions they are extremely valuable and useful feeds. High quality roughages are essential for all animals in the breeding herd and are especially important in rations for sows and gilts during the breeding season and gestation period. Some of the most satisfactory roughages for swine are discussed below.

Alfalfa Meal. This is an excellent roughage for swine and is a good source of Vitamin A (carotene), the B vitamins, minerals, especially calcium, and of unidentified factors. Due to its high crude fiber content it cannot be fed to growing-finishing swine at a level greater than about 5 percent of the ration without reducing gains.

Alfalfa meal is an ideal feed for brood sows during gestation. It helps to prevent over-fattening through its effect in controlling feed intake, and it also provides a good source of vitamins and minerals during this critical period. Excellent results have been obtained when alfalfa meal has been included in brood sow rations at levels up to 35 percent.

Price relationships may warrant the use of other feeds or supplements to supply vitamins and minerals, but the presence of unidentified factor(s) in alfalfa meal which are necessary for reproduction still provides sufficient reason for its use in swine feeds.

Alfalfa Hay and Other Hays. The general use of hay in rations for swine is not warranted except for the breeding herd. High quality alfalfa hay can be used effectively as a means of reducing the energy content of rations for brood sows and gilts. Alfalfa or other hays should be ground and mixed with the other ration ingredients when sows and gilts are maintained on a self-feeding program. Under such conditions, ground alfalfa hay can satisfactorily be used at levels up to about one-third of the total ration.

Silage. While silage has not been generally associated with swine feeding, recent research indicates that it may have value in rations for the breeding herd. The use of silage in rations is discussed in detail in a later section.

Pasture. Pasture of good quality provides the same nutrients as alfalfa meal and hay. Its greatest value is as a source of roughage for the breeding herd, although its use for growing–finishing swine remains common.

Pasture is a valuable source of vitamins and minerals and provides opportunity for exercise of brood sows and gilts during the gestation period. Exercise has always been considered important for the general well-being and

TABLE 4. PROTEIN LEVELS AND RATIOS OF CORN TO PROTEIN SUPPLEMENT FOR GROWING–FATTENING PIGS (32% Supplement)

	In dry lot			On pasture		
Live weight	50–100 lbs.	100–150 lbs.	150–200 lbs.	50–100 lbs.	100–150 lbs.	150–200 lbs.
Protein level	16%	14%	12%	14%	12%	10%
Approximate corn to supplement ratio	3:1	4:1	6:1	4:1	6:1	9:1

thriftiness of the sows and gilts and for the production of strong, vigorous pigs. Table 4 shows the recommended protein levels and ratios of corn to supplement for growing pigs on pasture and in dry lot.

FEEDING PRACTICES AND PROBLEMS

Sow Herd

Proper feeding of the sow during all periods of the production cycle is essential for a successful swine enterprise. When farrowing two litters per year, there will be only a few weeks during the year when the sow is neither in gestation nor lactation. Feeding during gestation is different from that during lactation both as to kind and amount of feed, and each is discussed separately. In general, a rule-of-thumb is a total feed requirement of 2000 pounds for a sow for one year. This will vary depending upon the size of the sow and on the number of pigs farrowed and raised per litter. However, the total feed required to raise a litter of 10 pigs to weaning is not greatly different from that required to raise 5 pigs. It is readily apparent that under such conditions the differences in feed costs per pig raised will be large.

Feeding During the Breeding Season

The breeding season is one of the most important periods in the over-all management program for the breeding herd. Gilts and sows are not likely to produce a normal number of ova during the estrus (heat) period if they have been improperly or under-nourished. Whenever either of these conditions exists, the litters will invariably be smaller than expected. Sows and gilts are more apt to be too fat than too thin. They should be in thrifty, vigorous, and gaining condition at breeding time. A sufficient number of good results have been obtained from "flushing" (having gilts or sows in a gaining condition for a week or two before breeding) to warrant its use.

Feeding During Gestation

A major problem in feeding sows during the gestation period is to prevent them from becoming too fat. Sows that are allowed to become too fat during pregnancy tend to farrow small, weak pigs. Hand feeding groups of sows presents the problem of the more aggressive sows being over-fed and the timid ones under-fed. This is especially true if limited trough space is available. When self-feeding sows or gilts, the rations must contain large amounts of bulky feeds such as alfalfa, ground corn cobs, or oats to control consumption and limit energy intake. Litter size, pig size, strength and livability of pigs from limited-fed gilts will be equal to or better than those from gilts allowed to become too fat during gestation.

Self-feeding sows on pasture during gestation provides good opportunity for exercise and reduces labor requirements.

Gestation rations must support the growth of the developing fetuses in addition to maintaining the sow. Therefore, the level and quality of protein, minerals, and vitamins in the ration is important. Nutrient intake during the final one-third of the pregnancy period is especially crucial because most of the growth of the fetuses occurs during this period. The daily nutrient requirement of gilts is somewhat higher per 100 pounds of body weight than that of mature sows. A gilt requires approximately 2 pounds of feed per 100 pounds of body weight, while a sow needs only about 1½ pounds of feed per 100 pounds of body weight. These levels of feeding must be adjusted up or down depending on the bulkiness of the ration. In extremely cold weather it may be desirable to increase daily intake somewhat to allow for energy expended to maintain body temperature. A desirable gain toward which to strive during gestation is approximately one pound per day for gilts and about three-fourths of a pound per day for sows.

The use of high quality pasture or forage for brood sows during the gestation period is important, and such feeds should be made available to pregnant sows whenever possible. In dry lot at least 10 percent alfalfa meal or hay is required for normal reproduction. Excellent results have also been obtained from rations containing higher levels of alfalfa (20–35%).

Some examples of rations suitable for self-feeding to brood sows during the gestation period are given in table 5.

Results obtained from studies on the use of silages in brood sow rations indicate that sows and gilts can utilize from 10–12 pounds of corn or legume-grass silage daily during the gestation

TABLE 5. RATIONS FOR SELF FEEDING TO SOWS DURING GESTATION

Ingredients*	Ration 1	Ration 2	Ration 3
	Pounds	Pounds	Pounds
Ground ear corn (yellow)	33.0	——	——
Ground yellow corn	——	55.5	——
Ground oats	30.0	——	39.0
Ground alfalfa hay (good quality)	28.0	35.0	39.5
Tankage or meat scraps	4.0	4.0	10.0
Soybean oil meal	4.0	5.0	10.0
Salt (plus trace minerals)	0.5	0.5	0.5
Steamed bone meal	0.5	——	1.0
Total (lbs.)	100.0	100.0	100.0

*Vitamins may be obtained in a feed pre-mix or in supplements. The requirements are: riboflavin, 1.5; niacin, 5.0; pantothenic acid, 6.0; and vitamin B_{12}, .005 mg. per lb. of feed. Vitamins A and D, 1200 and 60 I.U. per lb. of feed, respectively.

TABLE 6. RATIONS FOR SELF-FEEDING SOWS DURING LACTATION

Ingredients*	Ration 1	Ration 2	Ration 3
	Lbs.	Lbs.	Lbs.
Ground yellow corn	49.5	40.0	73.2
Ground oats	25.0	15.0	—
Ground alfalfa hay (good quality)	10.0	15.0	10.0
Wheat middlings	—	15.0	—
Tankage or meat scraps	7.0	6.0	6.0
Soybean oil meal	7.0	8.0	10.0
Steamed bone meal	1.0	0.5	—
Salt (plus trace minerals)	0.5	0.5	0.5
Dicalcium phosphate	—	—	0.3
Total (lbs.)	100.0	100.0	100.0

*Vitamins may be obtained in a feed pre-mix or in supplements. The requirements are riboflavin, 1.5; niacin, 5.0; pantothenic acid, 6.0; and vitamin B_{12}, 0.005 mg. per lb. of feed. Vitamins A and D, 1200 and 60 I.U. per lb. of feed, respectively.

period if it is properly supplemented with 1.5 pounds of protein supplement per day. Sows differ greatly as to the amount of silage they will voluntarily consume, and the importance of proper supplementation with protein and minerals cannot be over emphasized. Because of possible adverse effects on reproduction, moldy silage should not be fed to gestating brood sows.

Feeding During Lactation

The amount of feed required per day during lactation is two to three times that required during gestation. The T.D.N. value of this feed must be high to provide maximum energy. Since gestation and lactation rations are quite different in make-up and purpose, the period of change-over from one to the other is critical and requires extra care and attention. To prevent udder trouble at the onset of milk production, it is a good practice to supply fresh water to the sow and to withhold all feed for a period of 12 to 24 hours after farrowing. Two to three pounds of feed per day containing 20–25 percent wheat bran is an effective method of controlling constipation during this early period. Milk production gradually increases after farrowing until it reaches its maximum at approximately four to five weeks. The daily feed intake needs to be increased during this period so that the sow is on full-feed by the beginning of the third week. Lactating gilts and sows will consume up to 3 pounds of feed per day per 100 pounds of body weight during heavy production.

Some lactation rations suitable for self-feeding are shown in table 6.

Suckling Pigs

Milk is the most important feed for baby pigs. However, even when fed liberally, some sows are not able to supply enough milk to their pigs to meet their requirements for maximum growth. Under such conditions, it is possible to increase weaning weights considerably by supplying a high quality "creep ration" during the suckling period. Such a ration should be made available to the young pigs as soon as they begin to nibble at dry feed. This might be as early as a week or 10 days after farrowing.

Growing–Finishing Pigs

The period from weaning to market is one of rapid growth and changing nutrient requirements. The age and size at weaning will influence the type of ration that should be provided for the first part of the post-weaning period. The common practice has been to wean pigs at eight weeks of age. However, greater knowledge of the nutritional requirements of baby pigs has made it possible and often desirable to wean pigs at younger ages. Under most conditions it is desirable to leave the pigs with the sow until they are five to six weeks old.

Nutrient requirements for young pigs (6–12 weeks) are much more exacting than those of older pigs. As the pig approaches market weight a major part of the skeletal development and body protein deposition has already occurred. During the latter portion of the growing–finishing period, a large proportion of the energy intake is deposited as body fat. Protein can be converted to fat, but it is an expensive source of energy and might better be replaced by a cheaper energy source. A convenient way to reduce protein intake during the growing–finishing period is as follows: weaning to 100 pounds, 16 percent protein; 100 to 150 pounds, 14 percent protein; and 150 to 200 pounds (market weight), 12 percent protein. The protein content may be reduced by an additional 2 percent if pigs are fed on pasture.

Desirable Weight for Marketing

There is no good reason for carrying hogs beyond a weight of 220 pounds before marketing. Growth rate reaches a peak at about this weight and then declines, and feed efficiency declines continuously from birth to maturity.

Good quality meat-type hogs can be full-fed profitably from weaning to market weight without hindering carcass quality. However, fat deposition increases rapidly at weights beyond 200 pounds and the amount of fat is a major factor in appraising carcass qual-

TABLE 7. RATIONS FOR GROWING–FINISHING SWINE

Body weight	50–100 lbs.			100–150 lbs.			150–200 lbs.		
Ration*	1	2	3	1	2	3	1	2	3
	Pounds			Pounds			Pounds		
Ground yellow corn	74.0	75.7	60.0	79.2	80.7	65.0	85.4	86.7	65.0
Ground oats	—	—	19.0	—	—	19.0	—	—	19.0
Soybean meal	19.0	13.5	10.0	14.0	10.5	5.0	8.0	4.5	5.0
Meat scraps	—	5.0	5.0	—	3.0	5.0	—	3.0	5.0
Dehydrated alfalfa meal	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Steamed bone meal	0.7	—	0.5	0.7	—	0.5	0.7	—	0.5
Dicalcium phosphate	—	0.3	—	—	0.3	—	—	0.3	—
Salt (with trace minerals)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Ground limestone	0.8	—	—	0.6	—	—	0.4	—	—
Total pounds	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Plus an antibiotic and vitamin supplement. The vitamin requirements for a 50-lb. pig are: riboflavin, 1.2; niacin, 6.0; pantothenic acid, 50; and vitamin B_{12}, 0.005 mg per lb. of feed. Vitamins A and D, 400 and 90 I.U. per lb. of feed, respectively. Corresponding requirements for a 100–200-lb. pig are: 1.0, 5.0, 4.5 and 0.005 mg. of riboflavin, niacin, pantothenic acid and vitamin B_{12} per lb. of feed, respectively, and 400 and 60 I.U. of vitamins A and D per lb. of feed, respectively. A level of 5–10 mg. of antibiotic per lb. of feed is recommended for 50–200-lb. pigs.

ity. One should recognize that the apparent advantages of feeding swine to heavier weights to obtain a higher price per head are usually not justified because of the associated decreases in carcass quality and feed efficiency.

Suitable Rations for Growing–Finishing Swine

Differences in relative prices of feedstuffs will help to determine which feeds to use in formulating rations for growing swine. Examples of satisfactory rations are given in table 7.

Feeding Practices for Growing–Finishing Swine

Limited versus full-feeding. When feed intake is restricted during the growing–finishing period, growth rate and fat deposition are reduced. However, under most conditions this method of improving carcass leanness is inadvisable since time on feed is increased and softer carcasses are produced.

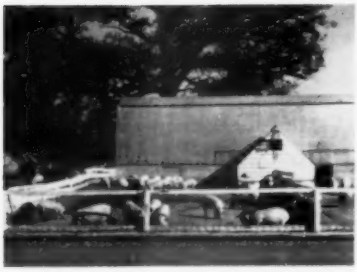
A fiber level of 6 to 8 percent in the rations for growing swine is generally considered the maximum amount compatable with maximum growth rate.

Pelleted versus meal-type rations. Controlled data comparing the costs and nutritive values of pelleted rations are limited. Some of the apparent advantages of pelleting swine rations are: less feed wastage; greater palatability, especially of fibrous rations; and increased total feed consumption.

Present costs of pelleting are high and may often be prohibitive, but improvements in pelleting methods and equipment may result in a greater use of this type of feeds.

Confinement versus pasture. The use of pasture has long been advocated for growing–finishing swine because it stimulated gains and supplied un-

Growing–finishing hogs on pasture nearly ready for market. Note the portable self-feeder and the portable waterer in the background.



Feeding hogs in confinement has been gaining in popularity. Note the large self-feeder that services two groups of hogs and the quonset-type shelter house in the rear.

known essential nutrients in abundant amounts. However, present knowledge of the nutrient requirements of swine permits the formulation of rations which provide a complete balance of nutrients and which makes outside sources of feed unnecessary. As a result, the number of hogs raised in confinement has increased rapidly during the past few years.

The results of numerous experiments comparing confinement and pasture feeding show small differences in growth rate in favor of feeding in confinement over pasture and a small but consistent advantage in feed efficiency and feed cost per unit of gain in favor of pasture-fed pigs. However, in most instances, the profits possible from alternative uses of the land would far exceed the saving of feed obtained from the use of this land as pasture for growing–finishing swine.

Free-choice versus complete mixture. The question of whether the cost of grinding and mixing home-grown grains is justified depends on whether or not the pig can do an efficient job of balancing his own ration. The relative palatability of the grain and protein supplement provided plays a major part in determining the amounts of each consumed, and in turn, the performance of the pigs and the cost of gain. Pigs on pasture have a tendency to do an inferior job of balancing their own rations, and consequently, they grow at a sub-optimal rate.

It is generally good practice to grind and mix rations containing barley or oats, unless grinding and mixing costs are excessive, because the high fiber content of these feeds may cause overconsumption of the more palatable protein supplement.

Effect of Feeding and Management on Carcass Quality

Protein level. The amount of protein in the ration of pigs on full-feed will affect their carcass characteristics. In general, a high-protein ration fed from weaning to market weight increases the amount of lean tissue in the carcass.

High energy ration. The use of fats in swine rations is receiving attention, and creep rations now commonly contain a small amount of animal fat to increase palatability and improve feed texture.

With the extreme importance of the "meat-type" hog, the addition of fat to rations for growing–finishing swine has only limited utility. The addition of fat to provide a high-energy ration early in the post-weaning period may be useful, but its utility late in the growing–finishing period is questionable because of its tendency to produce fatter carcasses. Optimum calorie–protein ratios have not been fully developed with swine, but the level of protein seems to be important in influencing the response to added fat. Available information indicates possibilities for utilizing fats early in the growth period to improve performance, and that they are of value in growing rations if they are removed from the ration at an early enough time in the growing period.

Feeding the Boar

The nutrient requirements of the boar are not so well defined as those of the sow, but in general, rations used for sows are satisfactory for boars. (See table 5.)

A daily intake of 1.5 to 2.0 lbs. per 100 pounds of body weight of a balanced ration, under most conditions is sufficient to maintain a boar during the breeding period. One pound of concentrate per 100 pounds body weight is sufficient to maintain the idle boar on good pasture. Excess fatness is to be avoided since it may adversely affect the boar's activity and aggressiveness. However, feed intake should not be restricted to the extent that the boar develops an unthrifty appearance.

Pasture should be utilized whenever possible because it supplies large amounts of vitamins and minerals and provides an excellent source of nutrients as well as an opportunity for exercise. During the winter months, or when pasture is not available, the ration should contain at least 10 percent alfalfa meal.

MANAGEMENT PRACTICES

Early Versus Conventional 8-Week Weaning

With the availability of highly fortified rations for young pigs, the possibility of removing pigs from the sow at ages younger than eight weeks has some attractive aspects. Much research is currently underway to answer questions and problems that arise in this kind of a program. While weaning pigs at five to six weeks of age seems to be practical under most conditions, weaning at younger ages presents special problems that the average producer is not equipped to handle.

Some advantages of early weaning are: sows require less feed during lactation (however, the saving in feed consumed by the sow may be offset to a large extent by the increased feed consumed by the pigs); sows can be rebred sooner if desired; and there is a possibility of heavier pigs at eight weeks of age.

Some disadvantages to early weaning are that: it requires superior management; the sow cannot cover up poor management with a constant milk supply; and the highly fortified rations required to replace sow's milk are expensive.

Another item to consider in determining whether or not to wean early is the question of how the early weaned pigs will perform from the nursing period to market weight. Evidence indicates that there may be adverse effects on subsequent performance under some conditions if early weaning is practiced.

The present high cost of rations for early weaned pigs is due largely to the high price of dried skim milk which makes up a large part of the ration. Efforts have been made to find suitable protein supplements other than skim milk for young pigs, but apparently their digestive system cannot efficiently handle proteins from other sources. Costs of rations for early weaned pigs will probably be reduced when ways of improving the utilization of low-cost ingredients are found.

Typical rations that have been used with success for pigs weaned as early as one to two weeks of age or as creep feeds are shown in table 8.

Raising Orphan Pigs

The death of a sow after farrowing, udder trouble, lactation failure, or litters larger than the sow is able to raise result in "orphan pigs". Two possibilities exist for the successful raising of such pigs. The use of a "foster sow" or the use of cow's milk or a sow's milk replacer. If another sow has far-

TABLE 8. SUITABLE CREEP RATIONS AND RATIONS FOR EARLY-WEANED PIGS

Ingredients*	Recommended for use at following ages				
	1 week	2–3 weeks	2–3 weeks	Creep	Creep
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Beet (or cane) sugar	16.50	10.00	——	10.00	——
Corn sugar	10.00	——	——	——	——
Ground yellow corn	17.00	33.10	60.00	41.00	40.00
Rolled oats	——	31.00	——	16.50	40.00
Dried skim milk	40.00	10.00	12.00	——	——
Dried whey	——	——	3.00	——	——
Soybean meal (50% solvent)	7.00	8.00	16.00	22.00	13.50
Tankage or meat scraps	——	3.50	7.50	——	5.00
Fish meal	5.00	3.50	——	5.00	——
Dried brewers yeast	1.00	——	——	1.00	——
Stabilized lard	2.50	——	——	2.50	——
Ground limestone	0.25	——	——	——	——
Steamed bone meal	——	0.40	1.00	——	1.00
Dicalcium phosphate	0.25	——	——	1.50	——
Trace element salt (iodized)	0.50	0.50	0.50	0.50	0.50
Vitamin and antibiotic supplement	to be added at levels recommended by manufacturer				

*The vitamin requirements are: riboflavin, 1.5; niacin, 10.0; pantothenic acid, 6.0 and vitamin B_{12}, 0.01 mg. per lb. of feed. Vitamins A and D, 800 and 100 I.U. per lb. of feed, respectively. A level of 20 mg. of antibiotic per lb. of feed is recommended.

rowed within a short time previously, the pigs may be transferred to her. However, this transfer must be made within a very few days after farrowing because those sections of the sow's udder that are not used soon cease their milk production. To insure acceptance of new pigs, the sow should be separated from her own litter for a short time when the new pigs are combined and a disinfectant or other material should be sprinkled on all the pigs to disguise odors.

Pigs can be raised on a sow's milk replacer without having had colostrum, but the task is laborious and painstaking. Baby pigs do not have an efficient body-temperature-control mechanism and an outside source of heat is essential for survival. The necessity for supplemental heat assumes even more importance when the pigs are subjected to the added stress of being deprived of sow's milk. Artificially raised pigs (those raised on cow's or synthetic milk) have a strong suckling instinct that drives them to suckle each other's ears and navel when kept together and causes commotion and unrest which drains their strength. The most suitable way to avoid this and to handle these pigs to prevent death by chilling is to house them individually. Wooden boxes or other draft-free pens equipped with light bulbs which will maintain an air temperature of 85–90° F. may be used during the first week. Best results will be obtained when the pigs are raised in a place remote from the swine herd.

The newborn pig can survive for about 24 hours without milk if kept warm, but the first feeding should be given during the first 12 hours if possible. Baby pigs may be trained to drink from a shallow bowl or a pop bottle and nipple may be used for the first few feedings.

Scouring (diarrhea) is a major problem in artificially raised pigs. It is easily caused by feeding too much milk. Therefore, the amount of milk fed should be reduced at least 50 percent or more for a feeding or two if the feces become loose. Best results will be obtained if the milk is warmed before feeding.

A good sow's milk replacer consists of one egg yolk thoroughly mixed with one quart of milk. This mixture supplies a well balanced diet, except for an iron deficiency. To compensate for the lack of iron, one-eighth teaspoon of ferrous sulfate should be added to one quart of milk. An injectable iron compound can also be used to supply the needed iron. When iron is supplied by one of the above methods, the milk–egg mixture can be used as the sole food source for the first three to four weeks of life.

Multiple Farrowing

The practice of arranging the breeding program so that groups of sows farrow at regular intervals throughout the year is called "multiple farrowing". Some of the important advantages and disadvantages of this practice are listed below.

Advantages

1. Usually results in a higher average price per pound for the market hogs than the customary twice-a-year marketings during periods of large receipts.
2. Provides for an income on a year-round basis.
3. Permits more efficient use of available equipment and facilities.
4. Reduces the investment per hog marketed.

Disadvantages

1. Requires a steady year-round labor supply.
2. Competes for the available labor supply during busy periods of the cropping season.
3. Some hogs may need to be marketed during the period of lowest prices.
4. Requires closer attention to sanitation and management practices.

Multiple farrowing systems of four and six times per year appear to be the most desirable. Under most conditions, the additional returns from farrowing more than six times per year are not sufficient to offset the increased management and labor requirements. For greatest efficiency, multiple farrowing programs should be planned so that the same number of sows are farrowed in each period as in one season under a system of two times per year.

Management Practices From Farrowing to Weaning

Iodine on Navel

The navel (umbilical) cord is a crucial area for the entrance of infection. A common malady, "navel ill", which can cause lameness or death, may result from failure to disinfect this cord at birth. The cord should be cut so that 1–2 inch remains and this portion dipped into a solution of iodine. This section will soon dry up and drop off leaving a clean, noninfected navel.

Needle Teeth

Baby pigs have 4 pairs of sharp teeth, two on each jaw called needle or "wolf" teeth. They are of no practical value to the pigs themselves, and they may irritate the sow's udder during nursing or cause injury to other pigs when they fight or play among themselves. Therefore, it is a good practice to clip these teeth shortly after birth. A side-cutting nippers is an especially good tool for this purpose. It is important to avoid loosening the base of the tooth, leaving jagged edges, or causing injury to the gums.

The injection of an iron-dextran compound is one of the most effective methods of preventing anemia in young pigs.

Prevention of Anemia

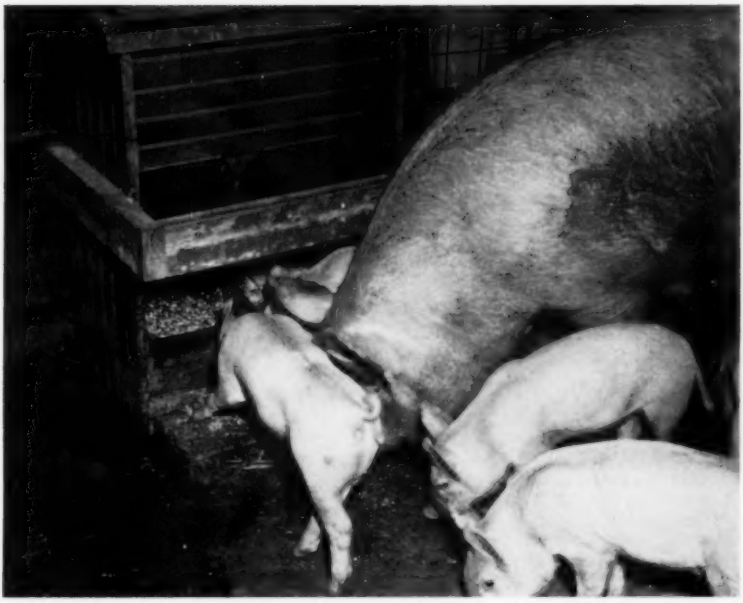
Anemia, which is caused by a deficiency of iron, is one of the most common nutritional diseases of baby pigs. This condition can be prevented and cured by supplying iron either orally or by injection. Oral administration consists of spraying or swabbing the sow's udder with a saturated solution of ferrous sulfate (1 lb ferrous sulfate in 1 gal. water) so that the little pigs will get some iron each time they nurse. To be effective this solution must be applied daily from the time the pigs are farrowed until they are eating solid feed. Commercial sources of iron in the form of pills or pastes, to be administered to the pigs individually, are also available. The practice of supplying fresh, but parasite-free, sod daily to the young pigs is also acceptable.

A more effective method of preventing anemia is the intramuscular injection of iron-dextran compounds. These compounds are available commercially and should be used in accordance with the manufacturer's recommendations.

Creep-Feeding

Baby pigs begin to develop an appetite for dry feed at about two or three weeks of age. This is primarily the re-

A creep feeder in use by pigs before weaning. Creep feeding is an excellent method of getting pigs off to a good start.



The addition of three pieces of 2 by 4 has converted this self-feeder into a creep feeder. The little pigs can eat but the sows cannot get at the feed.

sult of an increased feed requirement as they become larger. The provision of additional nutrients at this time is essential if maximum growth and development are to be achieved during the period from farrowing to weaning.

Nutrient requirements of young pigs are exacting and they require a well-balanced ration that is highly fortified with vitamins and minerals. Palatability is an important factor in creep rations because it stimulates the appetite and decreases the time required for the baby pigs to learn to eat dry feed. Sugar and lard are valuable components of creep rations because of their beneficial effects on palatability. (See table 8.)

Pigs prefer pelleted rations (⅛ to ¼ in. diameter), but meal-type rations are acceptable if not ground so fine as to be dusty.

The creep area may be partitioned so that only the pigs have access to it or it may be a feeder built so that only the pigs can eat from it.

Castration

The male pig can be castrated at any age but a good time to perform this operation is at three to four weeks of age when the problem of restraining the animal is minimal and the stress on the animal is not great.

Castration is a simple operation, and provided sanitary precautions are taken, infections or other complications are uncommon. A *clean* scalpel, razor blade, or sharp knife is the only equipment needed in addition to a disinfectant. Some producers prefer to make two incisions, one directly over each testicle, while others feel that a single

a

d

b

c

e

Steps in castration of young pigs. Extreme sanitary precautions are needed to prevent infection. Some prefer one incision (a, b, c, and d) while others prefer two incisions (e). The general procedure is the same for both methods.

incision between the testes is more satisfactory. The exact method used will depend on individual preference. Danger of infection is reduced if the incision is made to allow proper drainage from the wound.

Equipment, Trough and Feeder Space, and Shelter Requirements

Recommendations for trough and feeder space and shelter requirements for swine of various ages are given below:

Growing–Finishing Swine

1. The number of pigs per linear foot[a] of self-feeder space or pigs per self-feeder hole should be:

	On dry lot	On pasture
Weaning to 75 pounds	4	4–5
76 pounds to market	3	3–4

2. The percentage of self-feeder space alloted to protein supplements should be:

	On dry lot	On pasture
Weaning to 75 pounds	25%	20–25%
76 pounds to 125 pounds	20%	15–20%
126 pounds to market	15%	10–15%

[a]A linear foot is one foot of feeding or watering space. For example, a six-foot self-feeder with openings on both sides has 12 linear feet of feeder space. This same principle applies to trough space.

3. Three self-feeder holes, or 3 linear feet of mineral box space, should be alloted for 100 pigs when salt or a mineral mixture is fed free choice.

4. For hand feeding or watering in troughs, trough space per pig should be:

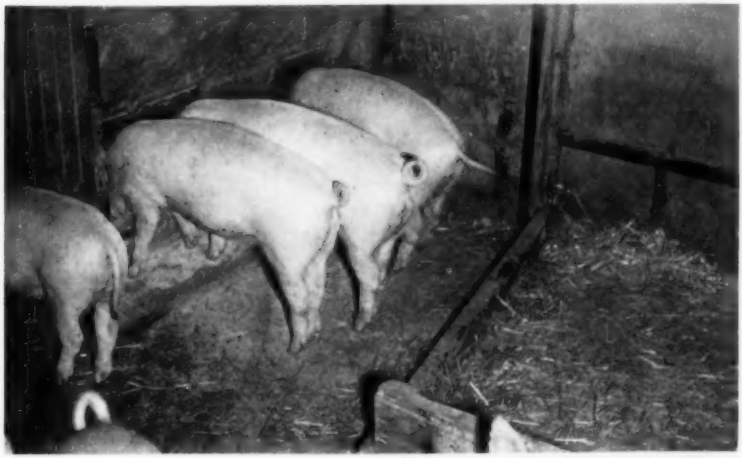
Weaning to 75 pounds	.75 feet
76 pounds to 125 pounds	1.00 feet
126 pounds to market	1.25 feet

5. When pigs are confined from weaning to market, 15 sq. ft. of feeding floor space should be provided per pig if the pigs are fed from troughs and 10 sq. ft. of feeding floor space if fed from self-feeders. This is in addition to sleeping space.

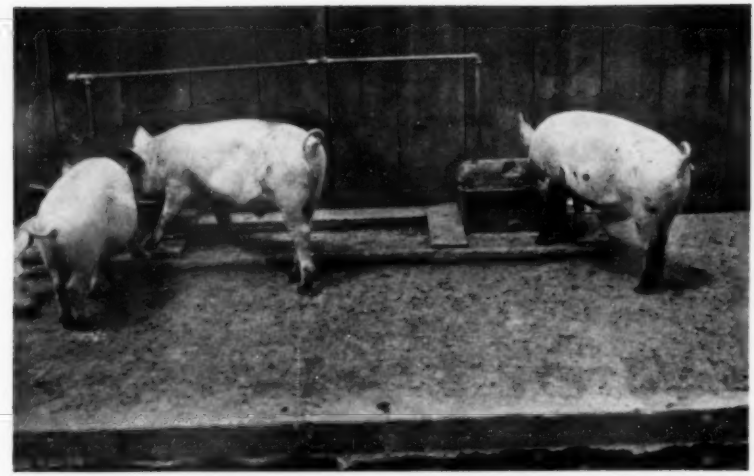
6. The area of shelter or sleeping space provided should be:

	Summer time (shade or housing)	Winter time (housing)
Weaning to 75 pounds	6 sq. ft.	4 sq. ft.
76 pounds to 125 pounds	8 sq. ft.	6 sq. ft.
126 pounds to market	10 sq. ft.	8 sq. ft.

7. One automatic watering cup should be provided each 20–25 pigs. (An automatic waterer with 2 openings should be considered 2 cups).



Young pigs can be closely confined when self-fed. Note the proximity of the bedding area to the feeder.



The use of automatic waterers for growing pigs insures a constant source of water and saves labor. Placing waterers on a concrete slab prevents the formation of mud holes around the watering area.

8. The minimum capacity waterer for 10 pigs per day should be 25 gallons in the summer time and 15 gallons in the winter time.

9. The water should not fall below a temperature of 35°F. during the winter.

10. The use of sanitary hog wallows during hot weather is recommended. Up to 50 pigs can be accommodated per 100 sq. ft. of wallow, providing shade or shelter is nearby.

11. On good legume or legume-grass pasture, allow 20 growing–finishing pigs per acre on a full feeding program and 10 to 12 per acre on a limited-feeding program.

12. Pigs of widely varying weights should not be run together. For best results the range in weight should not exceed 20 percent above or below the average.

13. Growing–finishing pigs may be expected to perform in accordance with the following:

A portable shade for pigs on pasture is essential during hot weather, and it also encourages more uniform grazing of the pasture. Note the individual hog houses in the background.

Although not as valuable as was once thought, the use of pasture for growing–finishing pigs still has many points in its favor, among which are an alleviation of parasitism and a decreased labor requirement.

Live weight	Av. daily gain	Daily dry feed intake	Feed per lb. of gain
Lbs.	Lbs.	Lbs.	Lbs.
25	0.8	2.0	2.5
50	1.2	3.2	2.7
100	1.6	5.3	3.3
150	1.8	6.8	3.8
200	1.8	7.5	4.2
250	1.8	8.3	4.6

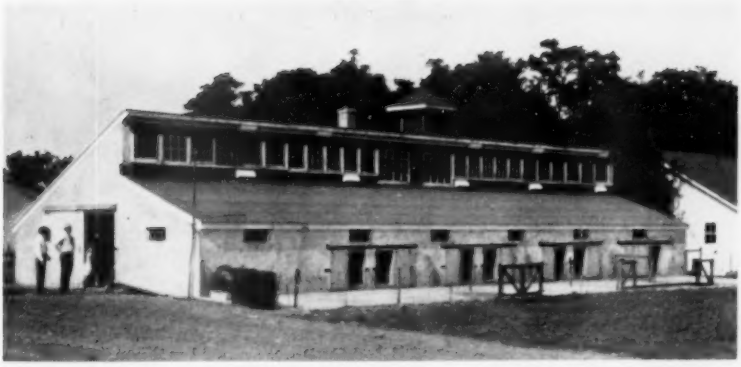
Sow and Litter

1. Farrowing pens in central or individual farrowing houses should have a minimum size of 6×8 feet for gilts, and 8×8 feet for sows.

2. Farrowing pens should have guard rails 8 inches above the bedding and 8 inches from the wall in either central or individual farrowing houses.

3. Farrowing stalls or crates should be 20 and 24 inches wide and not less than 6 and 7 feet in length for gilts and sows, respectively. The space beneath the bottom of the sidewall should be 10 to 12 inches. The width of area on each side of the stall or crate should be at least 18 inches.

Steer feeding and hog feeding are extremely compatible enterprizes. The grain passing through with the manure of steers fed a high grain ration provides a source of feed for pigs. Depending on their size and type of ration being consumed, three to five steers will provide sufficient feed for one growing–finishing pig.



A central farrowing house with an outside concrete slab provides an exercise and feeding area for the sows and pigs.

4. Recommended shade area is 50 square feet per gilt and litter and 60 square feet per sow and litter.

5. For self-feeding, in dry lot or on pasture, a minimum of 1 linear foot of self-feeder space or 1 self-feeder hole should be provided per sow or gilt and litter, provided additional creep feeding space is available to the young pigs.

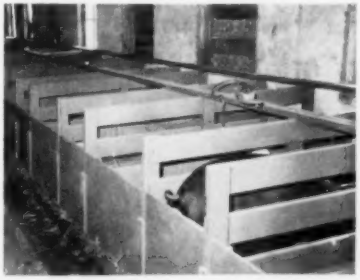
6. For hand-feeding in troughs, a minimum of 1½ linear feet of feeding space is recommended per sow or gilt and litter, provided the young pigs have additional feeding space in a creep.

7. For automatic watering provide at least 1 cup for each 4 sows or gilts and their litters. For hand watering in troughs, provide at least 2 linear feet of trough space per sow or gilt and litter. Additional watering space may be required during warm weather.

8. For creep feeding the maximum number of pigs per linear foot of feeder space should be 5. The edge of the feeder trough should not be more than 4 inches above the ground or floor. A maximum of 40 pigs per creep may be allowed.

9. If pigs are to be weaned at 5 weeks or earlier, the following conditions are recommended:

Age in Weeks	5	4	3	2	1
Minimum pig weight—lbs.	21	15	12	9	5
Farrowing house temperature—° F.	60	65	70	75	75
Minimum floor space per pig—sq. ft.	6	5	4	4	4
Maximum number of pigs per linear foot of feeder space	4	4	4	5	5
Maximum number of pigs per linear foot of water space	10	10	12	12	12
Maximum number of pigs per group	25	20	10	10	10



Dairy barns can be converted into farrowing units for hogs. Note the efficient arrangement of these farrowing stalls making it possible to handle a large group of sows at one time in a compact area and with a minimum of labor.

A satisfactory creep for sows and litters on pasture. Note the small opening that allows entrance only to the young pigs.

Breeding–Gestation

1. Provide an exercise area of approximately ¼ acre for the boar.

2. Breeding crates are recommended when breeding gilts to old boars or when mating large sows to young boars.

3. On good legume or legume-grass pasture, allow 10 to 12 gilts or 8 to 10 sows per acre.

4. Housing or shade per animal should be as follows:

	Winter (housing)	Summer (shade or housing)
Gilt, or junior boar	15 sq. ft.	17 sq. ft.
Sow, or mature boar	18 sq. ft.	20 sq. ft.

5. When sows and gilts are self-fed during gestation, the number per linear foot of feeder space, or self-feeder hole, should be as follows:

Pasture	3 to 4
Dry lot	2 to 3

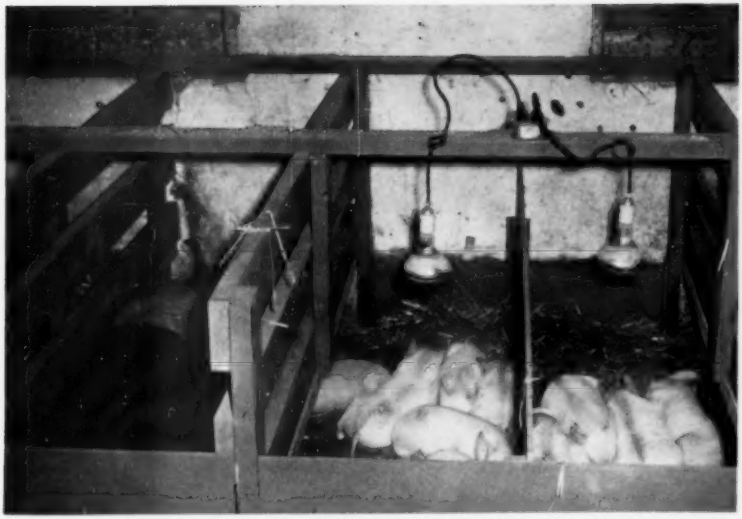
6. Provide 1½ to 2 linear feet of trough space per gilt or sow when hand feeding or watering.

7. When alfalfa hay is fed in a rack, 4 sows may be fed per linear foot of rack space.

8. One automatic watering cup should be provided for each 12 gilts, or for each 10 sows. Additional watering space may be required during warm weather.

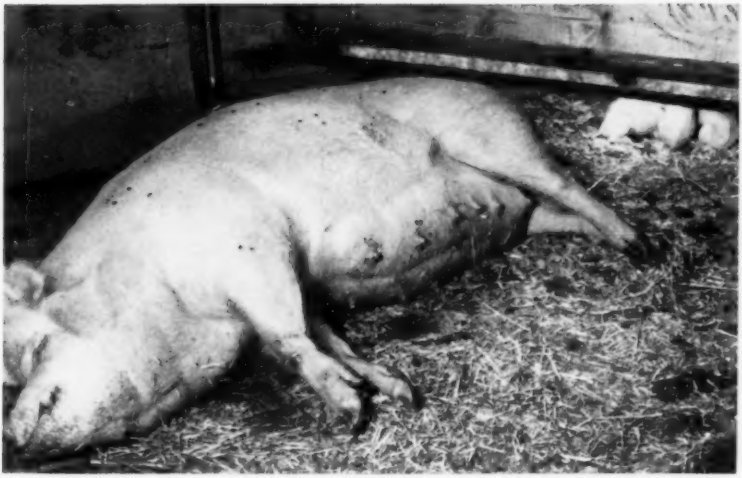
Farrowing Equipment

Adequate facilities for farrowing are highly important because one-third or more of all death losses before weaning result from over-laying or crushing. Mechanical devices such as guard rails and farrowing crates are valuable aids in reducing these losses. The latter are the more effective and are a good investment. A variety of farrowing crates are available and if they are equipped with self-feeders and waterers, sows may be kept in them continuously from farrowing to weaning. However, most producers will find it advisable to remove the sow and litter to other quarters about two weeks after farrowing. By this time normal pigs are quite active and crushing by the sow is not likely.



Farrowing crates arranged side by side with the bedding area for each litter equipped with a heat lamp. Note that the heat lamps are suspended directly from the cord. A better arrangement would be to have them suspended from a rope or cord other than the light cord itself.

An efficiently arranged farrowing stall that provides a creep-feeder and a supplemental source of heat for the baby pigs. To make the arrangement complete, a supply of water also should be available for the little pigs.



A hover (brooder) provides a nesting area for the baby pigs and protects them from the sow.

Heat Lamps and Brooders

Newborn pigs are extremely sensitive to low environmental temperatures and recent estimates indicate that swine producers can save an average of 1½ pigs per litter by using supplementary heat to keep baby pigs warm. This saving would more than cover the additional costs.

A satisfactory method of providing supplemental heat is a heat lamp. When used in a farrowing pen, the lamp should be suspended not less than six inches above the sow during farrowing. Immediately after farrowing, the lamp should be moved to a protected area of the pen. When used with farrowing crates, one lamp can be suspended on each side of the crate. Reflectors are useful in directing the heat downward to maintain a temperature of about 85° F. at floor level and in preventing damage to the lamp.

This hover (brooder) with a heat lamp and reflector can be set up in a corner of the farrowing pen to provide protection for the baby pigs from the sow and from cold drafts.

Pig brooders (hovers) are easily constructed and are standard equipment in many farrowing houses. If they are constructed to be approximately 10 to 12 inches above the floor, a 100-watt electric light bulb will provide sufficient heat.

Where cold weather is a problem, farrowing houses can be equipped with radiant heating which will maintain the desired temperatures for the baby pigs and the sow. However, expenses involved may deter this type of construction.

Breeding Programs

Selection of superior breeding stock is one of the most important ways of improving efficiency in swine production. There are several methods of combining the superior traits of different breeds or strains within a single breed. These are by: inbreeding—the mating of closely related animals; outbreeding—the mating of unrelated animals within a breed; or crossbreeding —the mating of animals of different breeds.

Effects of Inbreeding

In general, inbreeding results in a decline in over-all performance. Livability, growth rate, and feed efficiency are reduced. Strains of hogs that have undesirable traits such as hernia, inverted nipples, and cryptorchidism may manifest these characteristics when inbred. Conversely, inbreeding is useful in fixing the heredity of desirable characteristics so that they can be maintained when inbred animals are used in outbreeding or crossbreeding programs. The development of inbred lines of hogs for use in commercial production is costly and time consuming and is usually carried on by state and federal swine-breeding establishments.

Effects of Crossbreeding

In general, crossbreeding results in an improvement in over-all performance ("hybrid vigor"). Increases in growth rate and feed efficiency may be expected in crossbreed pigs, and a greater prolificacy and mothering ability is common among crossbred sows. Such increases may not be large or consistent but they occur in sufficient magnitude and frequency to encourage the use of crossbreeding in commercial production.

Three crossbreeding programs are: the simple two-breed cross; criss-cross breeding (purebred boars of two breeds used alternately, the gilts sired by a boar of one breed mated to a boar of a second breed); and rotation breeding (purebred boars of three or more breeds used on succeeding generations of gilts).

All crossbreeding programs can be effective in providing "hybrid vigor" if superior breeding stock is used.

Breeding Stock Selection

The selection of high-quality breeding stock is a vital part of a successful swine enterprise. To make progress with and improve a herd, those animals that possess and pass on economically desirable traits to their offspring must be identified and retained.

There are three methods of determining the desirability of an animal for a breeding-herd replacement. These are: individuality, pedigree, and performance.

Individuality is important in breeding-stock selection. Show-ring judging is an example of the use of this method as a measure of an animal's desirability, and such factors as general appearance, body conformation, degree of refinement of bone, and size for age are all taken into consideration. Only animals that are good representatives of their breed, are sound and in good

Measuring backfat thickness by live probing. Only a scalpel or sharp knife, a metal ruler and a disinfectant are required. Note the rope on the snout for restraint.

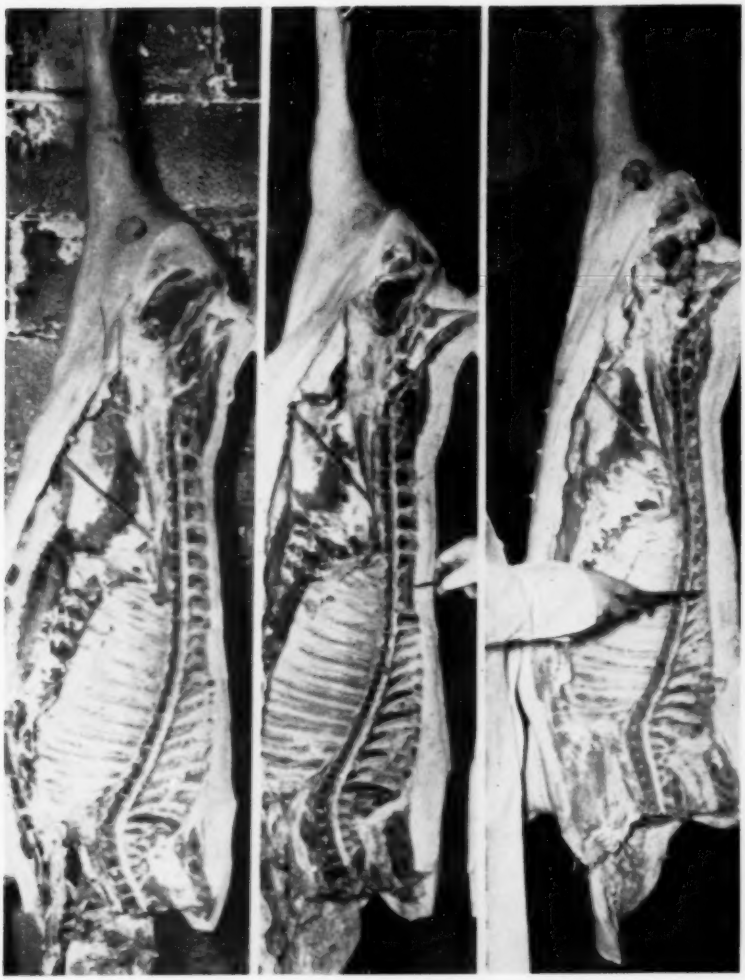
health, and have no serious faults in conformation should be selected for the breeding herd. Only a poor hog man would retain gilts with inverted nipples, crooked legs, and weak pasterns or select a boar that lacked substance of bone, ruggedness, and masculinity.

Visual appraisal of individuality is limited because body length, depth, and width can be based only on estimates. Backfat probing (measuring the thickness of backfat of the live animal) permits more accurate evaluation of the live animal in terms of carcass desirability. Several techniques for measuring backfat thickness are available, but a sufficiently accurate measurement can be obtained by the use of a scalpel or sharp jack knife and a metal rule.

Backfat thickness is determined by averaging the measurements taken over the shoulder, the mid-back, and the rump, each at a point about 1½ to 2 inches off the midline. The total amount of fat in a carcass is highly correlated with the amount of backfat; and since the latter is a highly heritable trait, rapid progress in developing leaner and more desirable hogs can be made through selection of gilts and boars with a minimum of backfat.

Pedigree. To the extent that "like begets like" and superior animals tend to produce superior offspring, pedigree is useful in breeding-stock selection. Selection of gilts and boars with ancestors who have consistently produced rugged, rapid growing, profitable pigs enhances the possibilities for genetic progress. However, beyond the third generation genetic relationship is diluted such that little importance can be attached to pedigree as a factor in influencing performance of progeny.

Performance is the best indication of an outstanding sow or boar because



Hog carcasses are graded according to backfat thickness and/or carcass length or weight. The three carcasses shown are representative of the U. S. No. 1, U. S. No. 2, and U. S. No. 3 grades. Note the excessive amount of backfat on the No. 3 grade carcass on the right.

Weighing pigs at a testing station to measure growth rate. Such measurements as these and feed consumption records are essential for the selection of breeding stock with the ability to produce rapid and economical gains.

The swine testing station and part of the South Dakota State College swine unit at Brookings, South Dakota. This testing station represents only one of many such programs designed to isolate and propagate superior strains of breeding stock.

even outstanding pedigrees or showring records cannot substitute for productivity. Performance can be appraised in two ways; by the performance of the individual himself and the performance of his progeny. In either case, economically important traits such as growth rate, feed efficiency, and carcass quality are of concern.

Performance-testing programs of various typs are being conducted in several states. These programs differ in details but their goals are the same; namely, to isolate and propagate superior animals. Such programs have been effective in increasing the quality and desirability of the swine from herds whose owners have been participating in the program. Swine that excel in growth rate, feed efficiency, and carcass quality (as indicated by backfat thickness) command premium sale prices. Performance-testing programs in which individual pigs are tested have an added advantage in that the sires of these pigs are simultaneously tested for prepotency.

Certain unsoundnesses in pigs are hereditary. Some of the most important to avoid in selecting breeding stock are listed below.

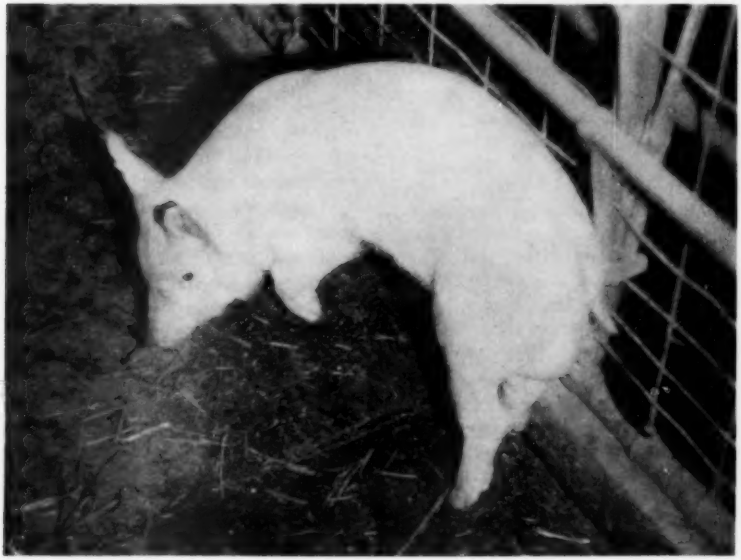
1. Umbilical hernia—rupture of the intestines into the umbilical area.

2. Scrotal hernia—rupture of the intestines into the scrotum.

3. Inverted or blind nipples—one or more non-functional nipples.

4. Cryptorchidism—one or both testes remain in body cavity.

5. Swirls—rosette-like arrangement of hair on the back or side. This is objectionable only in purebred breeding stock.



A young gilt with an inguinal hernia. This condition is similar to a scrotal hernia in boars, and both are inherited defects.

DISEASES AND PARASITES

Infectious Diseases

Hog Cholera

Cholera is the most serious swine disease in terms of annual losses. It is caused by a virus which may be present in the blood, body tissues, feces and urine of affected animals. The incubation period of the disease is three to seven days, but the first symptoms usually occur around the fourth day. These include loss of appetite and fever. Temperature may rise to 105° to 107° F. and be accompanied by coughing, inflamed eyes, and a reddish or purplish discoloration on the ears and underline. There is no effective treatment of affected animals. Animals that have died from hog cholera should be disposed of either by deep burying or through a rendering company.

Hog cholera can be controlled by following a careful and continuous routine program of vaccination under the supervision of a veterinarian.

The disease is spread either by contact between susceptible and infected animals, direct exposure, or contamination of the premises with hog cholera virus tracked in on shoes or by other similar means. Strict sanitation is helpful in controlling hog cholera, but it is difficult to enforce and carry out. The relatively low cost of immunization makes this method of control much more desirable.

Erysipelas

This is the second most serious swine disease in terms of annual losses, and it is caused by bacteria *(erysipelothrix rhusiopathiae)* which inhabit the feces and urine of infected animals.

The incubation period of the disease is variable, but the symptoms of the acute form closely resemble those of hog cholera, including loss of appetite, listlessness, and body temperatures of 106°–108° F. or higher. The disease may be spread by ingestion of infected feed and water or by entrance of the organism through cuts and scratches. These organisms survive for years in the soil. Pastures, sale yards, and similar places may harbor them for spread to susceptible animals which come in contact with the premises.

Mortality rate of the acute form varies from 0 to as much as 100 percent in severely acute cases. Red, diamond-shaped welts appear on the skin, hence the name "diamond-skin" disease. The common chronic form is most important and is characterized by lameness and swollen joints.

Erysipelas can be prevented by the proper and regular use of vaccines, but as with cholera, a veterinarian should be consulted for the most effective methods for control and prevention.

Transmissible Gastroenteritis (TGE)

This disease (caused by a virus) primarily affects suckling pigs, although pigs of any age may be affected. It is spread primarily by feces containing the organisms, but in close quarters, transmission may be through the air. The incubation period is 18 to 24 hours and symptoms include scouring, vomiting, and dehydration. There is little or no rise in body temperature, but mortality may be as high as 100 percent in pigs less than two weeks old. There is no effective treatment, but high levels of antibiotics in the feed reduce the danger of secondary complications. Spread of the disease is prevented by segregating the newly farrowed litters or by a break of two to three months in the farrowing cycle. Since sows that have had this disease pass on an immunity to their pigs, they need not be sold.

Brucellosis (Bang's Disease)

This disease, caused by bacteria, usually *Brucella suis,* results in large annual losses to the swine industry.

Swine are infected by ingesting contaminated feed, water, or body discharges. The symptoms are abortion, stillborn and weak pigs, small litters, or sterility. Some infected animals may be carriers of the disease without showing symptoms. Definite diagnosis is available only by blood testing the entire herd as individual blood tests are of little value.

There is no known cure, and infected animals should be sold for slaughter. Spread of the disease can be prevented by good sanitation and by purchasing breeding stock known to be free of brucellosis.

Several states have health programs underway which provide for individual swine producers acquiring "certified brucellos-free" herds. Continued efforts in this regard should eventually lead to the eradication of this disease in swine.

Leptospirosis

This disease is caused by bacteria, *leptospira pomona,* and is the most important single cause of abortion in swine.

It is spread in the same way as brucellosis and the principal symptom is abortion. Infected animals abort or farrow weak or stillborn pigs. Diagnosis is made by blood testing. The disease has special significance in that it can be spread to man.

High levels of antibiotics in the feed are effective in controlling leptospirosis if used properly. Vaccines for preventing the spread of the disease are available, and provide good protection if used regularly.

Virus Pig Pneumonia (VPP)

This disease is caused by a virus and is spread by direct contact of infected with noninfected animals (air-borne).

The symptoms are coughing and a 10–15 percent reduction in growth rate and feed efficiency. Since it is a chronic disease, it is not easily recognized and its adverse effect on performance may not be fully appreciated. It has been variably estimated that in the United States 40–60 percent of the swine are affected with VPP at present.

Diagnosis is by examination of the lungs at slaughter. Purple, fibrous lesions in the lower portions result from VPP. These lesions tend to disappear with age.

There is no known cure for the disease. Prevention is by removing newborn pigs from infected sows at birth and raising them in strict isolation. A few herds free from this disease have been established and more will undoubtedly follow.

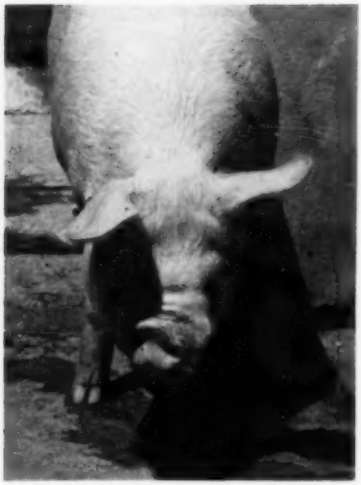
Atrophic Rhinitis (AR)

The causative agent of this disease is not yet known. It is thought to be spread by direct contact (air-borne).

The symptoms are sneezing and bloody discharge from the snout in young pigs. These early symptoms are followed by a degeneration of the turbinate bones in the snout so that the snout may become crooked or distorted. It is estimated that 10–20 percent of the swine in the United States are affected with AR at present.

AR results in reduced growth rate and feed efficiency, but as in the case of VPP, these adverse effects are difficult to evaluate. There is no known cure for the disease, but high levels of antibiotics in the feed of affected animals may allow nearly normal growth.

The disease can be prevented in the same way as that used for the control of VPP.



A pig showing a severe case of atrophic rhinitis. Pigs affected with this condition are greatly retarded in growth rate and in efficiency of feed conversion.

Other Infectious Diseases

The following are diseases of less significance, but deserving of mention: tuberculosis, anthrax, hemorrhagic septicemia (swine plague or pneumonia), vesicular exanthema, vibrionic dysentery, and necrotic enteritis. Consult a veterinarian if any of these or others are suspected.

Nutritional Diseases

Baby-Pig Anemia

This is a very common disease of baby pigs caused by a deficiency of iron. It is characterized by a reduction in the hemoglobin content (oxygen-carrying capacity) of the blood and results in a slow growth rate and a lowered resistance to disease. In advanced stages, pigs become unthrifty in appearance, show puffiness around the throat, and have labored breathing (called "thumps"). The disease affects suckling pigs primarily, since milk, their only food, is deficient in iron. Methods for prevention of anemia are discussed in the section on *Management Practices* (p. 27).

Parakeratosis

This is caused by an imbalance of calcium and zinc in the ration. Although primarily affecting growing–finishing pigs, it is important to supply rations containing optimum levels of calcium and zinc to swine of all ages.

Symptoms include a rough, scaly skin, which appears first on the underline and legs but eventually covers the entire body and retards growth. Since it looks like mange, the two maladies may be confused. The condition is rapidly alleviated by correcting the calcium-zinc imbalance. Rations containing more than 1 percent calcium are likely to cause parakeratosis if not supplemented with zinc. The addition of from 50 to 100 ppm. of zinc (4 ounces per ton of feed) in the form of zinc carbonate or zinc sulfate serves to completely cure and prevent parakeratosis.

Rickets

This is caused by a deficiency of calcium, phosphorus, or vitamin D, or an improper ratio of calcium to phosphorus in the ration.

Symptoms are slow growth and crooked legs. Mild cases of rickets involve a bowing of the front legs with no appreciable reduction in growth.

In advanced stages, the crooked bone formation cannot be corrected. However, correcting the nutrient balance of the ration early enough will result in no permanent damage.

Rickets can be prevented by supplying adequate calcium and phosphorus in the ration (in a 1.5:1 ratio) and suf-

ficient vitamin D. The vitamin D requirement can be met either by supplying it in the feed or by allowing the animal a few minutes of sunshine each day.

B-Vitamin Deficiencies

The B-vitamins most likely to be deficient in comon swine rations are riboflavin, pantothenic acid, niacin and vitamin B_{12}. They all cause slow growth; however, a pantothenic acid deficiency also results in locomotor incoordination called "goose stepping", and a vitamin B_{12} deficiency produces anemia in addition to slow growth.

Trace Mineral Deficiencies

Several minerals are required in minute amounts for normal performance. These "trace" minerals are usually present in sufficient amounts in common feedstuffs so that no deficiency problems are encountered. Trace minerals that have been associated with deficiency symptoms are: iodine, resulting in hairless pigs at birth; manganese, resulting in slow growth and abnormally short legs and body; copper, resulting in anemia, rough hair coat and weak legs; zinc, resulting in parakeratosis; and cobalt, (a component of vitamin B_{12}) resulting in slow growth and anemia.

Parasites

Much, if not most, of the mortality among young pigs is the result of parasitic infestations acquired early in life, even during the first few days. As a result, producers who are careless with their newly farrowed pigs frequently spend a great deal of time and money to alleviate conditions that result from parasitism. The old saying, "an ounce of prevention is worth a pound of cure," is very appropriate in swine operations; and the cardinal principle of prevention is *cleanliness* and *sanitation*.

Internal Parasites

Of all the parasites affecting swine, the internal are perhaps the most detrimental. These parasites vary widely in size, shape, structure and in degree of injuriousness to pigs. They cause pigs to be unthrifty, stunted, and poor converters of feed to pork. The common roundworm (ascaris suis) is perhaps the most detrimental and costly. However, lungworms and others are becoming more common and of increasing economic importance.

There are several treatments for the removal of roundworms in swine, but sodium fluoride and piperazine compounds are probably the most satisfactory. Cadmium salts are also good, but they have not been used as widely as the former.

A satisfactory treatment is the feeding of a mixture containing from ¾ to 1 percent sodium fluoride (technical grade) in dry ground feed. Such a mixture may be prepared by thoroughly mixing 1 pound of the chemical with 99 pounds of feed. If smaller quantities are desired, they may be prepared by mixing the materials at the rate of 1.5 ounces of sodium fluoride to 10 pounds of feed.

Precautions to follow when using sodium fluoride:

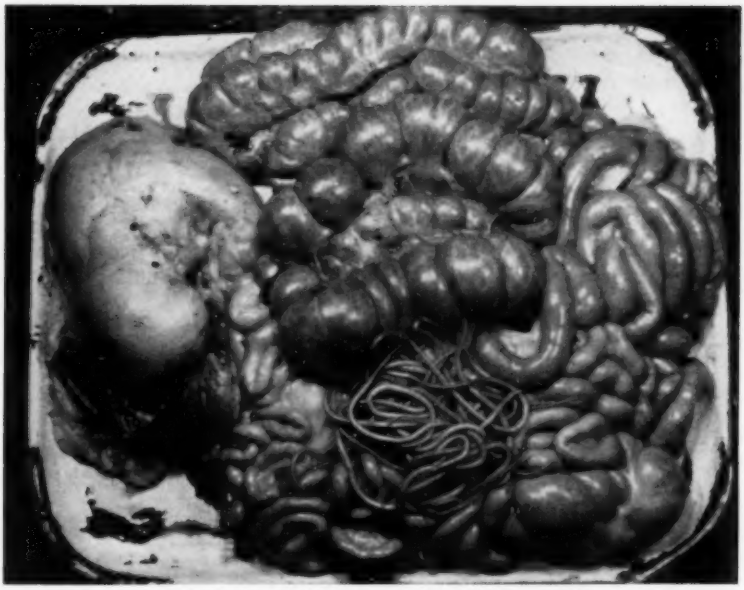
SODIUM FLUORIDE IS POISONOUS. Plainly label all containers and store out of the reach of children, household pets, or individuals not familiar with its poisonous nature.

Always weigh the feed and the sodium fluoride.

Use only dry ground feed and be sure that the feed and chemical are thoroughly mixed. Do not feed as a slop.

Feed the medicated feed for one day only.

Do not worm bred sows during the last half of pregnancy.



The digestive tract of a market hog showing a heavy infestation of adult round worms (ascarids) removed from the small intestine.

Piperazine compounds have two advantages over sodium fluoride. They may be used in either the dry feed or the drinking water, and they are relatively safe. When used in accordance with the manufacturer's recommendations, there is little danger of any toxicity such as might be encountered with sodium fluoride.

Hygromycin is a recently developed compound which has been reported to be effective in controlling roundworms, nodular worms, whipworms, and other types of internal parasites. One of its principal advantages is that it can be mixed with the feed and fed continuously as a component of the regular ration, but its effectiveness in the elimination of roundworms is not comparable to that of sodium fluoride, piperazine, or cadmium.

In worming swine, it is very important that it be done early enough. Also, pigs will generally benefit from two worming treatments before they reach marketable weight. The first treatment should be given when the pigs are six to eight weeks of age and the second treatment about four to six weeks later. The second treatment is particularly advisable if the pigs are in an environment conducive to heavy infestation with roundworms.

To insure getting a satisfactory dose of worm medicine into every pig, it is important that the pigs be properly prepared and the feed properly mixed according to the recommendations of the manufacturer. The pigs should be divided into groups according to size, so that even the smaller, runtier pigs, which probably have the heavier

roundworm load, will get sufficient medication to cause satisfactory elimination of the roundworms.

External Parasites

Lice are external parasites that exist by sucking blood from the live animal. When they are present, they are usually found on the flanks, shoulders, and back of the ears. Their eggs may also be observed on the hairs, close to the animal's body.

Two satisfactory treatments for lice are benzene hexachloride (BHC) and lindane. Both give satisfactory results and are most effective when applied as a spray, but other methods of application may be used. In spraying, best coverage is obtained when the hogs are crowded together in a small enclosure and the spray applied at reasonably high pressure to insure adequate penetration and coverage.

Precautions to follow when using BHC or lindane:

Follow the manufacturer's instructions for mixing the spray materials.

Do not treat pregnant sows or gilts within 30 days of farrowing or while they are nursing pigs.

Do not treat hogs within 60 days of slaughter.

Mix the spray continuously to insure uniform distribution of the active chemicals.

Do not breath the powder or mist.

Mange is a condition caused by a small mite that burrows into the animal's skin. It is spread quite rapidly by contact and is more apt to be noticed during the winter and early spring when the pigs are confined.

The treatment used for the control of lice is also effective in controlling mange.

FEED ADDITIVES

Feed manufacturers are supplied with a growing list of materials supposedly promoting the health and well-being of farm animals. Advertisements would lead one to believe that miracles can be performed by their use. While some of these compounds have attracted attention and then "died out", others have found a permanent place in rations for swine. Following is an evaluation of some of the common feed additives that have been used in swine feeds.

Antibiotics

Several antibiotics, including chlortetracycline (aureomycin), oxytetracycline (terramycin), penicillin, bacitracin, and streptomycin, have been used successfully to promote growth in young pigs when included in the ration in small amounts. Recommended levels have varied from 10 to 100 grams (one ounce equals 28.35 grams) or more per ton of feed, but levels of 10 or 15 grams per ton have been commonly used for weaned pigs with higher levels often added to creep feeds. Chlortetracycline has given the most consistent benefit, but others, or combinations of them, are also satisfactory. Inconsistent information exists as to the usefulness of antibiotics in sow rations. In most cases the positive effects have been too small to warrant their use for the breeding herd.

Arsenicals

Compounds containing arsenic, including arsanilic acid and 3–nitro–4–hydroxyphenyl arsonic acid, have been used to promote growth of young pigs. Manufacturers' recommendations range from 20 to 90 grams of these substances per ton of feed. Arsenic-containing compounds are toxic when used improperly. Their beneficial action oc-

curs through their effects on the intestinal microflora, an effect similar to that of the antibiotics. Feeds containing arsenicals should be mixed only by those equipped to measure and handle the additive effectively and safely.

Other Additives

Nitrofurans, effective in the control of various digestive disturbances of young swine, have received recent attention. Such substances include nitrofurazone and furazolidone. The extent of their future use awaits further investigation.

Hormones, including estrogens (diethylstilbestrol), testosterone, thyroxin, and others have not achieved importance as feed additives, since results from their use have been inconsistent and often negative.

Enzymes, including pepsin, trypsin, amylases and lipases have beeen used experimentally, but have not achieved importance as yet, although future research may uncover beneficial effects from their use.

Tranquilizers, including several chemical types, have given essentially negative results when fed to growing–fattening swine. Future value, however, may be demonstrated in stress situations such as at the time of weaning and marketing and in quieting nervous sows at farrowing time.

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